ENTOMOLOGICAL
SOCIETY OF
BRITISH COLUMBIA

PROCEEDINGS

OF THE

Entomological Society

OF

British Columbia

(INCORPORATED)

MARCH, 1933

Number 30

Victoria, B.C., 1933

PROCEEDINGS

OF THE

Entomological Society

OF

British Columbia

(INCORPORATED)

MARCH, 1933

Number 30

Victoria, B. C., 1933

TABLE OF CONTENTS

Notes on the Life History of the Entomological Society of British Columbia 3

Materials Used as Canker Paints in Woolly Aphis Control 8

Notes on a Serious Outbreak of Tick Paralysis in Cattle 11

Notes on the Tarnished Plant Bug in the Dry Belt of British Columbia 17

The Identity of the Carnation Maggots of British Columbia 21

A Convenient Method of Storing Entomological Specimens in Alcohol with Particular Reference to Dragonflies. 23

Some Food Plants of Lepidopterous Larvae 25

NOTES ON THE LIFE HISTORY OF THE ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA

By R. Glendenning, Agassiz, B. C.

About a year ago I was presented with three portfolios containing a quantity of old letters, etc., belonging to our Society. They had been resurrected from the vault of the Plant Inspection Office in Vancouver, and had not been dusted that morning, nor I think on any morning since the date that the covers bore, viz., 1914. I took them, purely out of a sense of duty and got my hands very dirty in consequence.

In my spare time since then, I have read all this correspondence and obtained much information and pleasure from these early records of the Society. In the hope that some of them may appeal to you in the same manner, I have ventured to extract certain items from this mass of dust-laden records.

The earliest history of our Society, which as you will remember was founded in 1901, has been set down by Mr. G. O. Day in his Presidential Address published in No. 4 of our Proceedings.

This address covered the period from inception in 1901 until early 1914. It is with the period immediately subsequent to this that these records deal.

As you know, although the Society was founded in 1901 and for some years led a useful if not very robust life, by 1909 it was practically dormant. No metabolism was evident, and it was not until 1911 that any signs of metamorphosis were apparent. This metamorphosis was holo-metabolic, and the Society emerged in the period from 1911 to 1914, from a small but keen coterie of lepidopterists mostly, to one of the most important scientific bodies in the Province.

The stimulating factor in this metamorphosis was the new secretary, Mr. Treherne, and the hundreds of letters in these musty files are irrefutable evidence of the amount of time spent by Mr. Treherne on the Society's affairs and I feel that I have been very negligent in comparison.

The first evidence of the resumption of metabolistic activity in the dormant Society is evidenced by correspondence with the late Rev. C. J. S. Bethune, of the Ontario Society, regarding by-laws and constitutions, and in our archives are a dozen or so folders of printed constitutions of various societies ranging from the rules of the Vancouver Horticultural Society to a 15-page booklet of the American Poultry Association.

In the original draft for a new constitution prepared by Mr. Treherne is a clause reading as follows:

"(4) To identify for, and render aid and assistance, to the best of its ability, or cause the same to be done, to fruit growers, farmers, gardeners and private individuals, either through the knowledge or advice of individual members in their respective localities or through the medium of the Society, its members and its publications, on all subjects relating to insect life, economically affecting the household, farm crops, fruit or livestock, or any other pertaining branch of agriculture."

This most ambitious clause was not adopted; and in a letter from the then president, Mr. Day, in 1913 he says:

"Article 4 appears to me to be outside the scope of our Society. We should be usurping the functions of the Provincial Entomologist, and moreover, would be putting too great a tax on our Secretary."

The subject of this clause is a most interesting one in the life history of our Society, and as it crops up in various forms in later correspondence I will refer to it again then.

Before this constitution was drawn up in 1913 the Society apparently was guided by some rules adopted at the spring quarterly meeting in April, 1902. In these rules Clause 9 calls for comment. It reads:

"9. Candidates for membership may be proposed and seconded at any meeting, and elected at the next meeting. Voting to be by ballot, and one black ball in three to exclude."

They were evidently very particular in those days, or else the general run of entomologists were more parasitically inclined than at present.

These rules are in the beautiful handwriting of Mr. Harvey, who was killed in the Great War. I also have the original manuscript of "A Preliminary List of the Macro-Lepidoptera of B.C." prepared in 1902, in the same beautiful script. I have brought it to show you as it shows how much the author was in love with his work and what care he lavished on its preparation.

Referring back for a minute we find several letters regarding affiliation with the parent body—the Entomological Society of Ontario—and a letter from the late Dr. Hewitt, then Dominion Entomologist, is interesting. He says:

"As you know, when the Society was formed it was the Entomological Society of Canada until it sold itself for a mess of pottage, which was indeed most necessary."

It was evidently Mr. Treherne's wish to have, and belong to, a National Society, but Dr. Hewitt found it quite out of the question for the Dominion to make a grant towards this, hence the Ontario Society.

One phase in the life history of this Society struck me most forcibly. That was the enthusiasm of the members. These archives are

studded with letters from members asking when the next meeting is to be held and where, and what papers were going to be presented.

Members apparently travelled all over the Province to attend in those days; but possibly it is not altogether lack of enthusiasm which limits the migrations of our members these times.

Another indication of active metabolism is indicated by a letter from Mr. Hanham in April, 1913. The Society was evidently not too flush in those days prior to the establishment of provincial grants, and he suggests members buy extra copies of Proceedings—and sends $2.00 for eight copies. He also wants to know "why Marmont and Dashwood Jones have fallen by the wayside."

Just before this episode the 1912 balance sheet showed a deficit of $6.50, and a whip around seems to have been made. This produced an anonymous donation of $20.00 from one member; and $5.00 each from Messrs. Sherman, Marmont, Lyne, Bush, and Wilson.

In 1913 Mr. Blackmore wrote:

"As regards offering anything for the programme, I don't think I would care to, as it appears to me that the majority (and a large one) of the members attending are all economic entomologists, and systematic entomology seems left out in the cold."

I believe this to be the original seed of dissension for this idea, which has periodically cropped up in the last 20 years of the Society's life. It appears to me similar to an inhibiting factor in the life history of an insect, not exactly parasitic, but more like a mild attack of polyhedral disease in tent caterpillars. Fortunately, the physical condition of our Society has been strong, and this natural control factor has never become epidemic, and proved fatal. It has often been ameliorated by timely application of soothing remarks in presidential addresses at various times in the past, but I would like to devise methods here and now to entirely exterminate this distorted and disturbing factor in the life history of this Society. In our archives are many letters from Mr. Treherne to the then powers in provincial matters—W. E. Scott, Price Ellison, etc.—regarding grants. The original grant was $250.00, but in 1914 Mr. Treherne, by means of strong economic arguments, obtained $350.00, and for some years after that the Society still obtained $250.00 to do what it liked with, while at the same time the provincial authorities printed our economic matter free.

The President, Mr. Day, in November, 1914, writes to Mr. Treherne in part, thus:

"You have indeed managed most cleverly and the result is indeed most creditable. You are a marvel of diplomacy and persistence. Your account of the negotiations for printing the Proceedings is most in-

teresting and I laughed as I read it. We are fortunate in having such an energetic Secretary."

Unfortunately, the account referred to above is not in our archives, but some indication of Mr. Treherne's difficulties and arguments are obtainable from the voluminous correspondence with the powers at Victoria. At one time a Mr. Ernest McGaffey suggested eliminating all the papers included in Proceedings No. 4, as many were too verbose. Treherne, however, stuck to his guns and by emphasizing the great scientific and economic value of the papers, got the whole lot printed.

I would like to point out and emphasize here that it has been this argument, and this only, that has obtained for our Society the annual grants that we have received in the past. We would never have received these sums for purely systematic work, and it has been only by forming a perfect emulsion of systematic and economic matter that the systematic writings of our amateur and professional entomologists have been published at all.

If any of our members still feel that systematic work is being squeezed out I would like them to remember this obligation to economic work—to remember that many systematic papers are submitted every year by professional economic entomologists who love that type of work far more than they do mixing up messy sprays—and to remember to produce papers themselves more abundantly.

Only thus can our Society throw off the polyhedral disease and live as a healthy symbiotic unit.

Leaving that subject now, I would like to turn to one or two other phases of our life history.

The first reference to the Great War is in a letter from G. R. Venables. It states that Mr. Venables will not be able to be present at the annual meeting as he is at the front, but suggests that he might be able to present a paper on Insects affecting Germans, though it might be censored!

In the agenda for the 1915 meeting is an expression of regret for the death of a Dr. de Verteuil, who went down in the "Good Hope" off the coast of Chile.

In this same agenda the election of the Rev. Canon Hinchliffe is proposed, and I found that earlier our present mayor, L. D. Taylor, was once a member.

At the January, 1914, meeting, several resolutions were passed and copies of the letters conveying these to the Hon. Premier, then Richard McBride, and the Minister of Agriculture are on file. The subjects covered were:

An investigation to confirm or refute the carrying of fire blight by hive bees.

The appointment of an entomologist to fill the position lately occupied by Dr. Brittain, and the suggestion that the position of Entomologist and Plant Pathologist be separated.

The prevention of the importation of bees on account of foul brood.

And lastly—Regarding the desirability of preventing insect collections being sold outside the Province to *foreigners.*

With regard to this last resolution I find one member commenting thus:

"I guess that resolution was framed on account of Mr. C's collection being in the market. His price is away too high, quite double what it should be."

Even entomologists are human and have their petty jealousies.

There are many more interesting items to be culled from a close study of these life history notes, but time will not allow for many more. However, in December, 1914, the Society nearly went to jail as the Secretary received a threatening letter from a collection agency for the account of a firm, amounting to $2.30. The only notation about this is a terse one in the Secretary's writing, "Paid."

I have one or two interesting relics—a faded photo of a collection of insects by one J. A. Hamilton, of which he was doubtless very proud at the time—hence the photo, full plate. And another in this un-redeemed postal note covering the subscription of a member. The Society is $1.00 poorer by this omission of the Secretary, but as the endorsee is dead and the sender passed away under tragic circumstances it is perhaps of more value as a souvenir or relic than in cold cash.

The records show very few lapses like this, but rather reflect the untiring energy and enthusiasm to further entomology that embued poor Treherne.

If some of the data presented herewith has interested you and enabled you to better understand the life history of our Society—its early struggles, its adaptation to natural conditions, its manner of life and increase, and its natural enemies—my labours in hunting through these life history notes of bygone years will have been of use.

MATERIALS USED AS CANKER PAINTS IN WOOLLY APHIS CONTROL

By A. A. Dennys, Vernon, B. C.

In 1929, the Vernon Dominion Entomological Laboratory was given the problem of finding a suitable way of controlling the woolly aphis of apple. The main idea was to find some material which would keep the aphids out of cankers and pruning wounds, thus preventing further extension or formation of these cankers. Control of the woolly aphis upon other parts of the trees can be secured by the addition of nicotine sulphate to one or more of the usual orchard sprays.

In Washington State many hundreds of materials had been used to control woolly aphis and perennial canker without much success, except by using high and expensive concentrations of nicotine.

Materials used in British Columbia by pathologists, before we took up the work, had been chiefly confined to vegetable oils such as castor oil, rape seed oil, etc. These oils kept out aphids by their physical oily properties for a short time, but failed to be really toxic to the insects.

During the past four years we have tested one hundred materials and mixtures in order to find one which would be 100 per cent. effective without injuring the tissues of the tree.

I would not like to weary you with the complete list of the many and varied materials that were used, but it is sufficient to mention a few, such as: vegetable oils, zinc chloride, mercuric chloride, derris compounds, pyrethrum, yeast solutions, quassia, pine oils, glues, nicotine compounds, mineral oils, tree tanglefoot, etc.

Some of these, more especially some of the vegetable oils, were promising, but their cost was against them.

It was in 1931 that we found that an emulsion of Castor machine oil 50 per cent. with water, plus 5 per cent. of nicotine sulphate, gave us 100 per cent. control of aphids. Cankers and wounds painted in July, 1931, were free of woolly aphis all that season, and even until June of the following (1932) season, in spite of heavy surrounding infestation during 1931.

However, it was found that some injury had occurred to the lower portions of the margins of some cankers painted with the 50 per cent. castor machine oil paint. This injury was not apparent until the spring following its application. It was, no doubt, caused by too great a concentration of oil at the bottom of the wounds.

An interesting point to mention, here, is that the increasing of the nicotine sulphate from 5 to 10 per cent. in this 50 per cent. emulsion in 1931 caused a large amount of injury to the callus, showing

that nicotine sulphate cannot be used with safety at much over 5 per cent. by volume.

Best Formula for General Recommendations

During 1932, many more experiments showed us that the mixture to be recommended, and one that would give excellent control of woolly aphids in wounds with no injury to the margins, was 25 per cent. Castor machine oil (heavy) plus 2½ per cent. nicotine sulphate, emulsified in water by means of wheat flour (5 per cent. by weight).

Emulsifiers

A word should be said about the emulsifiers. Several materials were tried out. We found that the best one for this heavy elastic-like Castor machine oil was ordinary wheat flour. Again, we found, although the flour did good work used raw, that by boiling it into a paste with the water, a very much more stable emulsion was formed. With the oil at only 25 per cent. in the emulsion it had a tendency to "cream" on standing when casein was used as a spreader, thus necessitating continuous agitation whilst using the paint. When the boiled flour paste is used as an emulsifier, the paint can stand at least 15 hours without "creaming."

Castor Machine Oil

This brief paper would not be complete without a word or two about this oil. It is **not**, as its name would seem to imply, connected in any way with the vegetable castor oil. It is in reality a solution of an aluminium soap in a mineral lubricating oil.

Each oil company has a slightly different formula, but in general the principal is the same. One brand of Castor machine oil used, contains 2½ per cent. of aluminium napthenate soap. The addition of this soap (which is insoluble in water) is made to an ordinary brown neutral oil. The consistency of the oil is thus changed from a free-flowing mineral oil to a peculiar elastic type of heavy oil, possessing a curious texture between a rubbery liquid and a jelly. It is used in commerce for slow-moving machinery, shafting, etc., and can be purchased at hardware stores.

What Gives the Castor Machine Oil-Nicotine Paint Its Toxic Qualities?

In order to test this out, experiments were made in 1932 with the component parts of the oil—that is the brown neutral mineral oil, and the aluminium napthenate soap. As the soap "pulp" was insoluble in water a solution in gasoline was used: it proved non-toxic to both woolly aphids and the tree tissues. The brown neutral oil seemed

slightly toxic to the aphids for a short period of the season, but also gave some severe injury to the tree tissues at 50 per cent. with water. It was shown definitely that the nicotine sulphate addition to the paint give it its toxic properties to woolly aphis. It is my opinion that the nicotine sulphate may form an oil soluble aluminium-nicotine-napthenate compound with the Castor machine oil, which makes its duration of toxicity considerably greater than that of the nicotine sulphate alone.

Before closing this paper it might be interesting to explain what led to the use of Castor machine oil in the first place. It is very often the case that some insignificant detail will bring out something of value; in this case, we heard of a grower buying pure castor oil for 60 cents per gallon. As the wholesale price is around $2.00, I proceeded to the store in question and purchased one quart of their so-called "castor oil." Upon asking if this bluish oil with a distinct mineral oil smell was really supposed to be vegetable castor oil, I was assured that it wasn't the pure article but contained quite a lot of it nevertheless! How far wrong this statement was has already been shown. Not wishing to pass by any possible materials, this oil was duly given a trial, with the result that we now have a canker and wound paint at a cost of approximately 40 cents per gallon which, if properly applied, can completely control the woolly aphids in wounds and cankers, and thus at the same time provide a satisfactory means of stopping the enlargement of cankers and wounds upon tender varieties of apples in the Okanagan.

NOTES ON A SERIOUS OUTBREAK OF TICK PARALYSIS IN CATTLE

BY ERIC HEARLE
DOMINION ENTOMOLOGICAL LABORATORY, KAMLOOPS, B. C.

Except in the case of sheep, most reports on tick paralysis deal with individual cases or at the most a comparatively few animals in a herd. In cattle, wholesale outbreaks are apparently extremely rare, and the writer in examining the literature on tick paralysis in North America, Australia and Africa has been unable to find any reference to an extensive outbreak of this nature. In early April, 1930, complaints were received of a "plague of ticks" causing losses in cattle in the Nicola district, and the writer was able to obtain some first-hand knowledge of a really serious tick paralysis outbreak of most unusual proportions. The particular spring pasture field in which the outbreak occurred has received much attention in our tick survey work during the last four years, but we have been unable to arrive at any very definite explanation for such an unexpected and intense outbreak. No further cases of paralysis have occurred in this field since 1930, but since that time only horses or mature cattle have been placed on this range during the tick season. Since there seem to be no further developments in this outbreak, it is thought advisable to report on it at this time.

The history of the outbreak is as follows: Subsequent to dehorning in the first week of April, a herd of 900 yearling steers was turned out on the usual spring range, which had been used for the previous fifteen years without any similar trouble. Several days after the animals had been turned out, it was noted that one or two were down with large numbers of ticks attached and showed evidence of paralysis. The ticks were taken off and the animals recovered the day after their removal. The situation became increasingly serious, however, and about April 14 as many as twenty head were observed down in one day. It was therefore planned to move the stock out of this range to another one further back, but before this was done it was decided, in view of the heavy infestation and weakened condition of the animals, to give treatment to effect the removal of the ticks; and the steers were accordingly rounded up during the four days following the 16th of the month and were treated in the dehorning chutes. The method of treatment consisted of hand-picking the larger engorged ticks (giving especial attention to animals showing "staggers") and applying the following mixture to the parts mainly affected by ticks: coal oil (4 gallons), lard (10-lbs.), sulphur (2-lbs.). This was applied to the back of the head, along the neck and shoul-

ders, and to about halfway back along the backbone. Animals down on the range or too weak to be brought in were hunted up and the ticks hand-picked. Many of the animals so treated recovered on the following day, but others in a more advanced stage of paralysis died rather rapidly, usually within two or three days of the onset of the trouble. Good mortality of ticks was realized by the above mixture, but it was inclined to cause blistering; and raw linseed or raw cottonseed oil, together with oil of pine tar, appeared to the writer to be preferable and was substituted and proved very successful.

Symptoms of Tick Paralysis in Cattle

The animals first appear "dopey," listless and disinclined to feed. They later show weakness and stagger slightly, the front legs appearing to be worst affected, often splaying out slightly in walking. Lack of co-ordination is marked. The weakness increases fairly rapidly and the animal collapses, usually assuming a characteristic attitude with the head thrown back against the shoulder. Much struggling may occur when the animal attempts to rise, the front legs usually doubling under, and the steer crashing on its shoulder and neck with such violence that one would expect the neck to break. On the steep sidehills the animals may struggle and drag themselves downhill for several hundred yards, but usually attempt to get into dense brush. In more advanced cases respiration is rapid and heavy, the eyes are staring and protruding and have a bluish-white appearance, and the coat becomes moist.

Temperature records of paralysed animals taken at Nicola on April 20 and 21 were as follows: 102.1, 102.2, 102.2, 102.4 and 103. These five cases had had all engorged ticks removed for about eight hours and some of them showed signs of recovery, all being practically recovered on the following day. The latter two animals had shown almost complete paralysis and lay flat on the side with the neck stretched out. Temperatures of three animals noted paralysed on the range, and which still had ticks on them, were 101.5, 102 and 103.

On removal of the ticks little change was noted at first, but in many cases within twenty-four hours the animals appeared quite healthy and active. The animals in more advanced stages of paralysis failed to recover and died within a day or two.

Amount of Infestation

A marked variation in the amount of infestation was noted in different animals, although the majority appeared to be fairly heavily infested. On a few steers no ticks or signs of previous attachment were noted. On the more heavily infested animals at least 150 ticks were estimated to an animal. In one case an animal had just died

and ticks (engorged, partly fed and flat) were noted leaving it. Eighty-two were collected on and near the animal, and this was probably only about half of the actual number infesting this beast, since ticks were noted on the ground in considerable abundance. In many cases as many as twenty or more fully engorged ticks were noted clustered at the base of the skull behind the horns and at the peak of the shoulder; these were the two favourite situations for attachment, although many were noted along the top of the neck and along the backbone to about the middle of the animal. Over one hundred specimens were examined and all proved to be **Dermacentor andersoni.** No **Dermacentor albipictus** were found, although this species occurred in some numbers on horses on this range in March.

Weather Conditions

Many exceptionally warm days occurred from early April to the 20th of the month, and animals brought in from the 17th to the 20th had large numbers of ticks on them, and as many as one-third going through the chutes showed signs of weakness and were "staggery." Colder weather commenced on the 21st and scattered showers occurred. The animals brought in on this day were noticeably less infested with ticks, and in a number of cases it was noted where ticks had been attached in numbers but had dropped, leaving many animals almost free. Only a very small proportion of the animals showed symptoms of paralysis on this colder day. About fifty steers that were missed in the first round-up were found higher up on the hill above 3,000 feet on April 23 and were almost free from infestation.

Range and Rodent Conditions

The range on which the tick infestation occurred has a south-west exposure and a fairly steep gradient, rising to an elevation of from 3,500 to 4,000 feet. Much open grassland occurs in the lower levels, bunch grass predominating and being unusually plentiful. (Water shortage due to the dry season protected the lower areas from over-grazing last year.) Somewhat sparse areas of greasewood occur here and there, and there are fairly extensive patches of brush, consisting of poplar, willow, black pine, wild rose, etc. An occasional solitary yellow pine occurs here and there. The higher levels are fairly heavily timbered, mainly with black pine. Several small lakes and sloughs occur fairly high up, and the lower levels are well watered early in the season with small streams. The cattle were mainly grazing low down, about 2,000 feet and under, and had not penetrated into the upper more densely timbered areas. There was little indication of poisonous plants.

Rodent conditions noted were as follows: A number of rocky outcrops provided excellent conditions for ground-hogs, which were particularly abundant. All through the open grassy areas pocket gophers were noted to be very numerous, and red squirrels were common in the timbered areas and scattered clumps of brush. Coyotes were evidently very scarce since the carcasses lying on the range remained untouched. Wood rats were stated to be rare, and Columbia ground-squirrels to be absent on this range. Chipmunks and white-footed mice were very abundant, however. Mule deer were not uncommon in the higher areas.

An interesting feature of this outbreak was that cattle on adjacent and somewhat similar range (except for exposure) were not affected and, as far as our information indicated, very little trouble from paralysis occurred in cattle elsewhere in the Nicola district. In spite of the unusual abundance of ticks in 1930, less than the average number of cases of tick paralysis were reported in cattle or human beings in the North Thompson valley and elsewhere in the dry belt; although a number of cases were later reported in sheep in the Nicola, Aspen Grove and Keremeos districts.

Number of Cases, Losses and Secondary Maggot Injury

Approximately one hundred animals, or over 10 per cent. of the herd, showed symptoms of paralysis and more than sixty-five of these were known to have died. Placing the value of steers at that time at $60.00 each, the loss from actual mortality amounted to $3,900.00. In addition to this direct loss the herd was weakened and set back, both from severe infestation with ticks and from the driving and handling necessary in carrying out control.

A serious secondary cause of injury resulted from severe maggot infestation noted in some sixty-five of the paralysed animals. In some cases the places attacked by ticks from the back of the head, over the shoulders and a little way along the backbone were infested with thousands of maggots, mainly quite small at the time. In some animals that were still living the vertebrae and bones of the shoulder were quite exposed. (The maggots when reared all proved to be the black blowfly, **Phormia regina,** the usual fly producing myiasis in sheep and cattle in British Columbia.) No such infestation was observed in animals that had not been paralysed. The contributory causes to this infestation appeared to be as follows: The forelegs of the animal seem to be most severely affected in the early stages of paralysis, and the steer, retaining a little strength in the hind legs, would attempt to rise, only to fall forward on the shoulders and neck. The broad tracks on the sidehills showed plainly where the animals had struggled and

rolled as much as several hundred yards down the slopes, causing abrasions and injuries in striking rocks, and in most cases tearing off the scabs on healed-over stumps of the horns and crushing engorged ticks. These injuries and the helpless condition of the animals which prevented them from fighting off the flies doubtless contributed to the amount of maggot infestation. The possibility of serious losses from this infestation led the writer to advise further treatment to prevent this. The coal oil-lard-sulphur mixture applied for tick treatment, while most effective in killing the ticks, did not appear to have any lasting properties for repelling blowflies; and it was therefore suggested that oil of pine tar be used to afford protection to such animals as showed injuries which would offer suitable conditions for blowfly infestation. It was also advised that if it were found impracticable to burn or bury the dead steers on the range, these should be well soaked with creosote oil to reduce fly breeding.

Synopsis

Unusually severe outbreak of tick paralysis occurred in a herd of 900 yearling steers at Nicola, B.C., in April, 1930.

Cattle were treated with coal oil-lard-sulphur mixture to remove ticks. This mixture was found to cause blistering, so raw linseed or raw cottonseed oil, together with oil of pine tar, was substituted with satisfactory results.

Many animals recovered within twenty-four hours of treatment, but others in more advanced stage of paralysis died rather rapidly, usually within two or three days of the onset of the trouble.

Average infestation was about 150 ticks to an animal. Infestation occurred at the back of the head, along the neck and shoulders, and to about halfway back along the backbone. All ticks examined proved to be **Dermacentor andersoni.** No **Dermacentor albipictus** found.

Weather had been exceptionally warm, but turned colder from the 21st of the month. Infestation was markedly less during cold weather.

Range had southwest exposure and rose to elevation of 3,500 to 4,000 feet. Much open grassland, with fairly extensive patches of brush. Higher levels fairly heavily timbered. Cattle were grazing at the time on lower levels.

Chipmunks, white-footed mice, red squirrels, pocket gophers and groundhogs were very abundant; mule deer occasionally noted on higher levels; coyotes, wood rats and Columbia ground-squirrels were absent.

No trouble was noticed on similar adjacent range; and number of cases of tick paralysis in humans and cattle in the dry belt during that year was lower than usual.

Approximately 100 animals, or over 10 per cent. of the herd, showed symptoms of paralysis; 65 were known to have died, making a loss from actual mortality of $3,900.00.

Severe infestation by maggots of **Phormia regina**, which occurred only in paralysed animals, threatened further serious loss. Affected cattle were treated with oil of pine tar to afford protection from blowflies.

NOTES ON THE TARNISHED PLANT BUG IN THE DRY BELT OF BRITISH COLUMBIA

BY E. P. VENABLES

Published records dealing with tarnished plant bug injury are generally confined to the insect in its relation to truck crops, flower gardens, and nursery stock. Injuries to bearing fruit trees, while occasionally mentioned in the past, have increased considerably throughout the Pacific Northwest during the past few years, particularly in those areas in which irrigation is practiced.

The followng notes are based upon observations made in different sections of the Okanagan Valley between 1927 and 1932, and deal particularly with the insect and its relation to apple and pear trees grown under irrigation.

Approved orchard management, in most sections of British Columbia, includes the growing of cover crops in the orchard in order that soil fertility may be maintained, and protection afforded to the tree roots during the winter.

There is no doubt that this practice has produced conditions particularly suited to the multiplication of the tarnished plant bug.

Orchard cover crops may consist of either alfalfa, sweet clover, or vetches, and of these alfalfa is the most widely grown.

Without entering into the management of these different crops in detail it may be said that our observations have shown that the permanent growing of alfalfa results in conditions particularly suitable to the multiplication of the tarnished plant bug, and that this crop is particularly attractive to the insect in late fall, for hibernation.

Injuries to Apples and Pears

The most serious type of injury to these trees is caused by the puncturing of the unfolding buds in early spring, by the adult insects, which have survived the winter.

The first effect of these punctures is to cause an exudation of sap from the bud, at the site of the puncture. This exudate forms large droplets on the buds and in the case of pears may be so profuse as to cover not only the buds but also the spurs and twigs on affected trees. Apple buds injured by the tarnished plant bug generally die within a short time; pear buds being considerably larger at the time injury occurs, frequently produce some leaves and may set a few blossoms, unless the injury has been very severe.

The fruit of the pear and apple is attacked early in the season, the result being that development of the fruit is checked at the point where feeding has taken place. The appearance of apples which have been attacked by the insects in early summer is distinctive and takes

the form of a deep conical depression in the surface of the fruit, which in many cases may reach to the core. Pears may be attacked in late summer when the fruit is almost mature and injury at this time may seriously lower the grade of the fruit.

The Influence of Cover Crops On Fall Population

In order to show the influence of different types of cover crops on tarnished plant bug population it is of interest to present the results of quantitative collections of the insect made during the late summer and fall of 1931, when particular attention was paid to the activities of the insect prior to hibernation.

This data was secured by regular periodical samplings of certain areas growing various types of cover crops, including alfalfa, sweet clover and vetch. These collections were made at Vernon in alfalfa and vetch; at Penticton in alfalfa and sweet clover, and at Kelowna in alfalfa.

A total of twenty-two collections of tarnished plant bug were made between August and the end of October.

A large number of insects of various kinds were taken in these collections and 132,868 were actually counted and the number per acre of several species estimated therefrom. The data covering this work has been illuminating and has shown in the clearest manner that the type of cover crop and the type of soil have a direct bearing upon the abundance of certain pests of the orchard. It is not possible to present all the data covering this work, including as it does numerous graphs and tables dealing with several species of insects, but the final result has been to show that alfalfa as a cover crop is most favourable to **Lygus pratensis** for hibernation. The population was found to be always higher in alfalfa, and in the fall a well-defined migration occurs from areas growing sweet clover and vetches to the alfalfa, where hibernating conditions are most favourable.

The Influence of Cover Crops On Spring Population

Information on the distribution of the tarnished plant bug in spring, after leaving hibernation, was secured by the use of the sweeping net.

A total of 100 sweeps were taken as a unit in each experiment, the sweeps being made in as uniform a manner as possible, and were carried out in orchards in which different methods of cover crop management had been practiced.

The following shows the results of collections made at six different stations in Penticton.

St.	Crop	Cultivation	Dry Cover	Insects	Remarks
I	Alfalfa	No fall discing	Thick	14	
II	"	No fall discing	Thin	11	
III	"	Fall discing	No cover	14	
IV	"	No fall discing	Fair	41	Orchard protected from wind.
V	"	Fall discing	Poor	12	Orchard sprayed with L.S. and oil
VI	"	No fall discing	Good	12	Sprayed with L.S. 1-9

From the above it appears that neither the type of cultivation, nor the absence of hibernating sites, have much effect upon the number of insects present in the alfalfa in the early spring after the insect leaves hibernation, but that they become quite evenly distributed over wide areas during the warm days of April and May.

Other collections than those tabulated were made in a number of orchards under varied types of cultivation with results quite similar to those shown above.

The Influence of Orchard Exposure On Plant Bug Population

In 1931, some observations were made which indicate that exposure may play an important part in regard to the prevalence of the insect.

At station No. IV the insects were almost four times as numerous as in other stations growing similar cover crops. In this area almost entire protection from the prevailing cold winds was afforded by surrounding higher land. This area included about two acres of pear trees, many of which had bud damage of over 90 per cent. The bugs were numerous within this sheltered area, although one hundred yards away an average of only twelve to fourteen insects could be taken in the usual sweeping.

Notes On Oviposition

The eggs of the hibernating brood have been found quite commonly in alfalfa stems during April, usually at the base of the current season's growth, when the plants were about four to six inches in height. These were located just above the soil in the rough portions of the stem, where numerous abrasions and small cracks are commonly found. In some cases the eggs were inserted in well-defined splits in the stem, near the ground level.

No eggs were found in the smoother portions of the stems, or at a height more than two inches above the soil. Isolated plants with strong crowns seem to contain most eggs.

In some cases the eggs were found inserted at right angles to the stem, in other cases they were placed at an angle immediately beneath the epidermis. Eggs may occur singly, or in groups of six or more, and in one case eight were found, in one small area.

A few eggs have been found in apple buds, and the young apples are also used for oviposition to some extent.

Control

The control of the tarnished plant bug has been the subject of many experiments in the past; nothing outstanding, however, has yet been developed.

Under conditions as they occur in the orchard sections of British Columbia it would appear that cover crop management may offer a partial solution in preventing damage.

Repellent sprays of certain standard materials have been tried with doubtful results.

The application of lime-sulphur, both alone and in combination with oil, at the time the bugs become active in the spring, is claimed by some growers to be fairly effective. Counts made on April 15, in pear orchards which had received lime-sulphur sprays between March 21-23, showed the following percentage of injured buds:

L.S. 1-8 plus 4% oil	Buds dead, 12.8%.	Buds injured, 20.5%
L.S. 1-9 alone	Buds dead, 4.2%.	Buds injured, 34.8%
L.S. 1-20 plus oil (3%)	Buds dead, ...	Buds injured, 10.0%
L.S. 1-20 alone	Buds dead, ...	Buds injured, 18.0%
Check trees, unsprayed		Buds injured, 34%-71%

Tests made with 5 per cent. nicotine dust against the adult insects were aparently of no value. Several hundred tarnished plant bugs were enclosed in a wire screen cage and the nicotine dust blown in with a hand rotary duster. The insects all fell to the ground and were apparently dead, but at the expiration of half an hour the insects appeared as active as ever.

In any case, control based on the destruction of the adult insects would have to be applied over wider areas in order to be effective. Reduction of injury by cover crop management seems to offer some hope of results, but will require to be tested over a considerable acreage in order to arrive at correct conclusions.

Contribution from the Dominion Entomological Laboratory, Vernon, B.C., based on observations made by Mr. E. P. Venables and Dr. R. D. Bird, between 1927-1932, in the Okanagan Valley of British Columbia.

THE IDENTITY OF THE CARNATION MAGGOTS OF BRITISH COLUMBIA

BY G. J. SPENCER

At a previous meeting of this Society (in 1928) I made brief mention of an Anthomyid fly which was destroying large numbers of young carnation plants in the spring of 1927, in a greenhouse in New Westminster. The insect appeared shortly afterwards in the greenhouses of the University at Point Grey. At this time it was identified for me by Dr. H. Huckett of Long Island Vegetable Research Station, New York, the North American authority upon Anthomyid flies, as **Hylemyia brassica** Bouche and under this name I reported it in the Proceedings of this Society.

At the International Congress of Entomology at Ithaca, New York, in 1928, I met Dr. F. W. Edwards of the British Museum, who stated that carnations in England are commonly attacked by a specific carnation maggot, **Hylemyia brunnescens** (Zetterstedt), and that the insects in question in British Columbia were most probably of this species.

Later on, in 1930, another infestation broke out in the University greenhouses among young carnation plants grown from cuttings, and it developed that the plants were being attacked in two ways. In the first case, injury was the same as in previous instances, consisting of the eating-away of the stem underground and slightly above ground, both from a side and up through the centre, precisely as the cabbage maggot eats young cabbages. But the second type of injury was a new one in that the maggots were working altogether away from the soil in the leaf-heads of the growing plants, eating away the bases of the leaves and the tips of the stems and burrowing down a short distance into the stem so that the leaves fell asunder and the plants withered and died from the tips downwards.

As many maggot-infested stems as could be found at the time were collected and caged above one of the larger pots of earth in which they had been growing, so that the maggots when full grown could pupate in the soil. Some pupated in the soil and some in the dead and dried heads of the stems. Within a month, but at varying intervals, a series of large and small Anthomyid flies emerged and were pinned. From the fact that emergence occurred over a period of time, I gathered that several larvae had entered the soil before the second series had been placed in position.

This whole second series of flies was sent to Dr. Huckett and his identification has just come to hand. The larger flies are the true carnation maggots of Great Britain as foretold by Dr. Edwards,

namely **Hylemyia brunnescens** (Zett.), but the series of smaller ones falls into three species of which one, **Helina duplicata** (Meigen), is represented by one specimen only, while the rest belong to two species, **Hylemyia florilega** (Zett.) and **Caricea humilis** (Meigen).

At the time of caging the maggots there was no suspicion of more than two species being present and until further rearing has been done, the identity of the species most concerned with the injury to the leaf tips, can only be suggested.

The largest number of small flies obtained was of the species **Caricea humilis** (Meigen), but of this species Dr. Huckett says, "I have frequently seen this species in greenhouses; I believe the larvae feed on grass roots and underground stems." Accepting this suggestion, we must rule out this species. The second largest number of flies reared were of the species **Hylemyia florilega** (Meigen) and I am inclined to believe that this is the species most concerned, unless both species are involved.

Since 1930, no further reports of maggot injury to carnations have come to hand from any source. It would appear that **H. brunnescens** (Zett.) is sporadic in its outbreak or else is imported afresh, and that none of the other three species mentioned need be greatly feared for their attack upon carnations in the Vancouver district.

A CONVENIENT METHOD OF STORING ENTOMOLOGICAL SPECIMENS IN ALCOHOL, WITH PARTICULAR REFERENCE TO DRAGONFLIES

BY E. R. BUCKELL
ENTOMOLOGICAL LABORATORY, VERNON, B. C., MARCH, 1933

One of the best methods of making a permanent collection of dragonflies and certain other insects is to preserve them in alcohol in glass vials.

It is hoped that this paper may help anyone who may be contemplating making a collection of any material that is best preserved in alcohol as it will, I think, help to overcome some of the difficulties met with when trying to make an easily handled and neatly labelled collection.

While this paper has particular reference to dragonflies, most of the observations will apply also to other alcoholic materials.

The only alcohol that is really satisfactory for preserving dragonflies is 95 per cent. grain alcohol. In this material they will keep their colours excellently, which they will not do in ethyl alcohol or other preservatives such as chloral hydrate, formalin, etc.

The best type of vial to use is the thick-lipped homeopathic vial with the widest mouth that the diameter of the vial will allow. The advantages of the homeopathic vial over the shell vial are twofold. In the first place the thick lip allows the cork to be forced in very tightly without fear of breaking the vial. In the second place the vial can be easily made entirely airproof by the addition of a "gelcap" which, when soaked in cold water until soft, can be placed over the cork, and when dry will mould itself around the glass lip, making a perfect seal.

The corks should be the best 4XXXX corks of the short type so that they will not protrude downwards into and discolour the alcohol.

The British Columbia dragonflies can be kept in two sizes of vials. The large size should measure 25x95 mm., and the small 20x66 mm In ordering these it should be specified that the mouth in both cases be as wide as possible and in no case less than 16 mm. inside dimension.

When collecting in the field the dragonflies should be taken out of the net and placed at once, tail first, into vials of 95 per cent. grain alcohol, and a piece of paper giving the locality and date put in with them. If you wish to kill them in cyanide bottles first do not leave them in any longer than necessary or the colours may change considerably.

When you have determined your material and wish to put it away in a permanent collection the following method is suggested:

With India ink write the species name on a small black-edged label and fill in the date on your locality label.

Put a few small specks of sodium silicate (which can be purchased in the form of "water-glass" for preserving eggs) on the face of the species label and with a pair of forceps place it inside the vial at the bottom and press it against the glass with a rubber-ended pencil until good contact is secured, and then tamp down a plug of cotton wool to hold it in place until dry. Treat the locality label in the same manner, placing it on top of, or alongside the species label.

The sodium silicate will dry very rapidly and will ensure the label remaining in place and appears to be absolutely insoluble in alcohol. When the labels have adhered firmly to the glass take out the cotton wool and place the dragonflies tail down in the vial and fill up to the neck with 95 per cent. grain alcohol; put in the cork and seal with a "gelcap."

The most convenient method of storing the finished vials is in small racks which may be any length desired. These are made with the back and base of three-ply and the two ends of half-inch pine. The base should be slightly narrower than the diameter of the vials to be used; the vials being kept in place by two strands of wire stretched between the end pieces. The best type of wire to use is No. 0 tinned picture wire as this does not stretch and become slack. The back and base may be painted white or may be covered with a soft white cloth, resembling cotton wool on one side, known as "eiderdown." The front end of the rack should be stained and have a brass card holder attached, into which the typed name of the species may be slipped. When fastening these card holders a small brass cup hook or knob may be screwed through the lower nail hole and used as a handle when pulling the racks out of their cabinet. These racks may be kept on shelves in a cabinet with sliding glass doors. A curtain should be provided which can be drawn to exclude the light as the colours of dragonflies keep best in the dark.

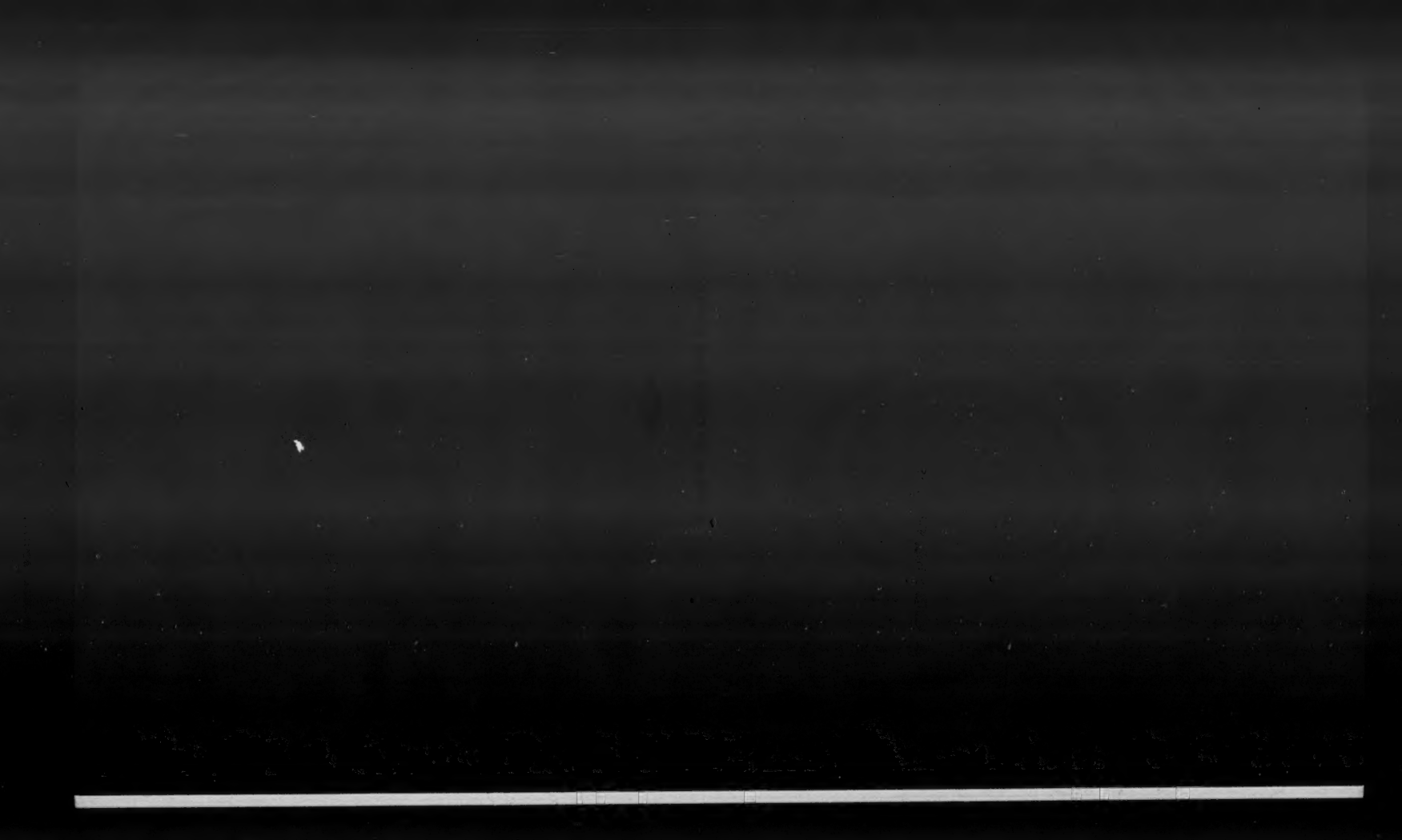
The vial racks and cabinet can be made with very little cost and add to the pleasure of an alcoholic collection. The method of fixing the labels inside the vials by means of a few spots of sodium silicate is very convenient and satisfactory.

SOME FOOD PLANTS OF LEPIDOPTEROUS LARVAE

BY J. R. J. LLEWELLYN JONES

RHOPALOCERA

Papilio zelicaon.	parsnip, garden variety.
Polygonia satyrus.	stinging nettle.
Hamadryas milberti.	stinging nettle.
Cynthia cardui.	thistles.

HETEROCERA

Hemaris diffinis, rubens	lonicera nitida.
Telea polyphemus.	maple.
Halisidota argentata.	white fir. (balsam) (Have been known to eat wild flowering currant and sallow (broad leaved).
Isia isabella.	spirea, (small white (preferred.) plantain, (narrow leaved).
Arctia caia.	stinging nettle.
Agrotis c-nigrum.	dandelion, chick-weed, plantain, groundsel, clover (red), huckleberry, viola and pansy.
Lycophotia margaritosa.	cabbage.
Polia cuneata.	alder, sallow, flowering currant, bird cherry.
Heliophobus procincta.	grasses, clover (red and white), vetch (pea vine).
Perigrapha praeses.	bird cherry, sallow, spirea (small white).
Septis castanea.	alder, sallow (broad leaved), maple, wild flowering currant, snow-berry, bird cherry, wild cherry.
Chutapha periculosa.	stinging nettle.
Panthea portlandia.	Douglas fir.